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(71) Applicant: HONDA GIKEN KOGYO KABUSHIKI KAISHA
Minato-ku Tokyo (JP)

(72) Inventors:
- Hasegawa, Yosuke
  Wako-shi, Saitama (JP)
- Itabashi, Takeyasu
  Wako-shi, Saitama (JP)
- Hayashi, Kanji
  Wako-shi, Saitama (JP)
- Wakabayashi, Takeshi
  Wako-shi, Saitama (JP)
- Bunya, Osamu
  Wako-shi, Saitama (JP)

(74) Representative: Liska, Horst, Dr.-Ing. et al
Postfach 860 820
81635 München (DE)

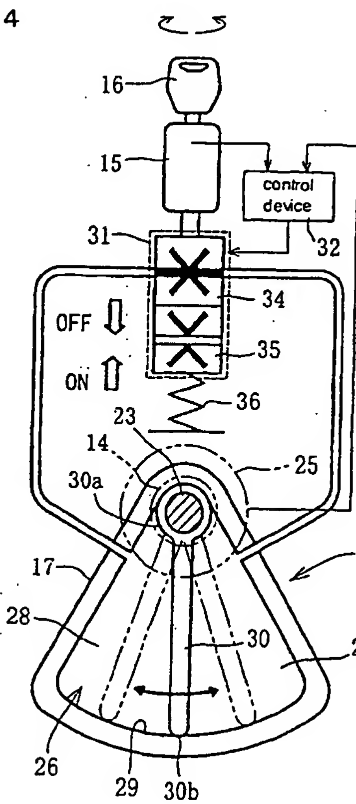
(54) Saddle-ride type vehicle steering damper apparatus

(57) Purpose; If a steering damper is fixed to a top bridge, as the steering damper is comparatively heavy and the top bridge is on the steering side, steering inertia increases.

Accordingly, arrangement structure of the steering damper which does not greatly influence the steering inertia is realized.

Construction: A rotatable partition wall 30 is provided in a hydraulic chamber 26 of a steering damper 10 to partition the inside into right hydraulic chamber 27 and left hydraulic chamber 28. A shaft 23 provided at one end of the partition wall 30 is integrally and rotatably coupled to a coaxial steering shaft 14. The both hydraulic chambers 27 and 28 are communicated with each other by a liquid passage 33, and a control valve 31 provided in an intermediate part of the passage is switched to a lock 34 or a throttle 35 thereby a damping force zero status or a damping force generation status is set. The switching is controlled by a control device 32 in correspondence with ON/OFF of a main switch 15. Further, the throttle 35 makes a cross-sectional area of the passage variable, and this control is also made by the control device 32 based on a turning angle speed of the steering shaft 14. A comparatively heavy part such as a main body 17 forming a casing of the steering damper 10 is fixed to a vehicle body front part supporting the steering shaft 14, and the comparatively light-weight partition wall 30, on the steering side.

FIG. 4



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Description

[0001] This invention relates to a hydraulic steering damper apparatus for a saddle-ride type vehicle such as a motorcycle, used for controlling oscillation of handle upon running, and more particularly, to an apparatus which can provide variable damping force.

[0002] To prevent oscillation of handle due to kickback upon external perturbations, a hydraulic steering damper apparatus which produces a damping force to the oscillation is known (as an example, Japanese Patent No. 2593461). Further, an apparatus for producing a variable damping force arranged to produce a damping force only when necessary, while not to produce the damping force in other cases, is known. For example, an apparatus which performs control based on a steering angle and a running speed (Japanese Published Unexamined Patent Application No. Sho 63-64888) and an apparatus which performs control based on a change in load on a front wheel (Japanese Published Examined Patent Application No. Hei 7-74023) are known.

[0003] If such steering damper is fixed to a top bridge, as the steering damper is comparatively heavy weight and the top bridge is on the steering side, steering inertia is increased. Accordingly, an arrangement of steering damper not to greatly influence the steering inertia is desired, and the present invention has an object to meet the requirement.

[0004] To attain the above object, the invention in claim 1 of saddle-ride type vehicle steering damper apparatus is characterized by a saddle-ride type vehicle steering damper apparatus in a saddle-ride type vehicle having a steering damper in which a hydraulic chamber filled with working liquid is formed in a casing, the inside of said hydraulic chamber is partitioned into two small hydraulic chambers by a rotatable partition wall provided in the hydraulic chamber, these small hydraulic chambers are communicated with each other via a liquid passage with a throttle, and a damping force is caused by relative rotation between said partition wall and said hydraulic chamber, wherein a rotation shaft of said partition wall is coupled to a steering shaft supported rotatably to a vehicle body front part, and wherein said casing is fixed to said vehicle body front part.

[0005] According to the invention in claim 1, among the steering damper constituents, the comparatively light-weight partition wall is provided on the steering side while the heavier casing is fixed on the vehicle body side, therefore, increase in steering inertia can be suppressed. Further, the space-saving rotation shaft side is provided on or around the comparatively space-lacking steering shaft while the larger casing is provided on the comparatively spacious vehicle body, therefore, the steering damper can be easily arranged.

[0006] The invention in claim 2 is characterized in that in the above-described claim 1, said partition wall has said rotation shaft at a rotation radial direction inner end, and wherein a rotation radial direction outer end as the other end rotates along an inner wall of said hydraulic chamber.

[0007] According to the invention in claim 2, as the hydraulic chamber, accommodating the partition wall which rotates about the rotation shaft co-axial with the steering shaft in approximate sector shape, can be provided in the casing on the vehicle body, the capacity of the hydraulic chamber can be increased so as to increase a damper effect.

[0008] The invention in claim 3 is characterized in that in the above-described claim 2, a main switch is provided in a top bridge supported rotatably to said vehicle body front part via said steering shaft, and wherein the main switch and the rotation radial direction outer end of said partition wall are provided to be opposite to each other with said steering shaft therebetween.

[0009] According to the invention in claim 3, as the major portion of the steering damper and the main switch are positioned on opposite sides with the steering shaft therebetween, the steering damper can be arranged sufficiently away from the main switch so as not to disturb key operation at the main switch. Thus excellent key operability at the main switch can be maintained.

[0010] The invention in claim 4 is characterized in that in the above-described claim 2, the throttle of said liquid passage and the rotation radial direction outer end of said partition wall are provided to be opposite to each other with said steering shaft therebetween.

[0011] According to the invention in claim 4, as the throttle of the liquid passage and the rotation radial direction outer end of the partition wall are provided on opposite sides with the steering shaft therebetween, the liquid passage can be comparatively short and be provided around the steering shaft, and the throttle can be provided, with spatial allowance, away from the rotation radial direction outer end of the partition wall where the width of the hydraulic chamber expands to a maximum width.

[0012] The invention in claim 5 is characterized in that in the above-described claim 2, said throttle has a variable throttle mechanism, and wherein a control member of the variable throttle mechanism and said partition wall are provided to be opposite to each other with said steering shaft therebetween. As a control member of the variable throttle mechanism, a control valve, this control device and the like can be used.

[0013] According to the invention in claim 5, in a case where the throttle has a variable throttle mechanism, as the control member of the variable throttle mechanism and the partition wall are provided on opposite sides with the steering shaft therebetween, the liquid passage can be comparatively short and be provided around the steering shaft, and the control valve and the control device and the like as the control member of the variable throttle mechanism can be provided, with spatial allowance, away from the rotation radial direction outer end of the partition wall where the width of the hydraulic

chamber expands to a maximum width.

[0014] The invention in claim 6 is characterized in that in the above-described claim 1, said casing is provided above said steering shaft and a turning angle sensor is provided above said casing, and wherein a rotation shaft of the turning angle sensor is coupled to the rotation shaft of said partition wall.

[0015] According to the invention in claim 6, as the rotation shaft of the turning angle sensor is coupled to the steering shaft by engagement, the rotation shaft and the steering shaft can be easily coupled to each other, and by directly coupling the both shafts, the turning angle of the steering shaft can be precisely measured.

[0016] Preferred embodiments of the present invention will be described hereinafter with reference to the accompanying drawings. It is illustrated in:

Fig. 1: A perspective view of motorcycle to which the working example is applied.
Fig. 2: A side view of the vehicle front part showing the steering damper device portion.
Fig. 3: A plan view of the above portion.
Fig. 4: A diagram showing the schematic structure of the steering damper.
Fig. 5: A side view of a portion around the steering damper according to the other working example.

[0017] Hereinbelow, a first working example will be described with reference to the drawings. Fig. 1 is a perspective view of motorcycle to which the present-working example is applied; Fig. 2, a structural side view of vehicle body front part where a steering damper is provided; Fig. 3, a plane view of the same part; and Fig. 4, a diagram showing the schematic structure of the steering damper.

[0018] In Fig. 1, an upper part of a front fork 2 supporting a front wheel 1 at its lower end is coupled to a front part of a vehicle body frame 3 and is rotatable by a handle 4. A fuel tank 5 is supported on the vehicle body frame 3. Reference numeral 6 denotes a seat; 7, a rear cowl; 8, a rear swing arm; and 9, a rear wheel.

[0019] Next, the steering damper will be described. As shown in Figs. 2 and 3, a steering damper 10 is provided between a top bridge 11 to which the handle 4 is attached and a head 3a as a front end of the vehicle body frame 3. The top bridge 11 is integrated with a bottom bridge 12 in a lower position in pair, holding a steering shaft 14 supported by a head pipe 13 therebetween. These top bridge 11 and bottom bridge 12 and the steering shaft 14 integrally rotate.

[0020] Respective upper parts of pair of left and right front forks 2 are supported by the top bridge 11 and the bottom bridge 12. The head pipe 13 is a pipe-shaped part integrally formed with the head 3a of the vehicle body frame 3. Note that the vehicle body frame 3 has the head 3a and a main frame 3b as a pair of left and right parts extending left rearward and right rearward from left and right positions of the rear end of the head (Fig. 3).

[0021] A stay 11a projecting frontward is integrally provided with a front central part of the top bridge 11, a main switch 15 is supported here, and unlock operation, switching operation and the like are performed by operation of key 16. Numeral 15a in Fig. 3 denotes a key hole in which the key 16 is inserted. Note that the main switch 15 is an electric system switch to turn powers of engine ignition system, lamp system and the like ON/OFF. A handle lock to fix the handle 4 unrotatably to the vehicle body side upon parking is integrally formed with the main switch. The key 16 also serves as a handle lock unlock key.

[0022] The steering damper 10 of the present working example is a hydraulic damper to prevent kick back. It has a main body 17 and a lid 18 (Fig. 2), and its rear side is fastened to a boss 21, projecting above and integrally formed with an upper surface of the head 3a of the vehicle body frame 3 around the head pipe 13, by a bolt 20. At this time, the main body 17 and the lid 18 are integrated by fastening. The boss 21 is previously provided with a nut. Note that the main body 17 and the lid 18 construct the casing of the steering damper of the present invention.

[0023] A step 3c which is one-level higher is formed in a rear upper surface of the head 3a in left and right positions of the boss 21, and a stay 5a formed in left and right positions in a front end of the fuel tank 5 is attached here via rubber 22a by a bolt 22b in vibration proof status. The stay 5a is projected toward the vehicle body central side from both sides of front end of a concave member 5b opened frontward and upward at a front center of the fuel tank 5, and overlapped with the step 3c around a position where the front end of the main frame 3b is connected.

[0024] An air cleaner 19 is provided under the fuel tank 5, and its front end is attached to an attachment member 3d at a rear end of the head 3a by a bolt 19a in a position below the concave member 5b. The attachment member 3d is projected continuously from the step 3c rearward and toward a position below the concave member 5b (Fig. 2).

[0025] A shaft 23 is provided with its axial line upward and downward in Fig. 2 through a front part of the steering damper 10. A lower end of the shaft 23 is projected downward from the main body 17 of the steering damper 10 and engaged with an upper end of the steering shaft 14, thereby simply coupled in a status where both shafts are rotatably integrated. The shaft 23 is provided coaxial with the steering shaft 14.

[0026] Numeral 24 is a steering nut which fastens the upper end of the steering shaft 14 to the top bridge 11. The lower end of the shaft 23 is passed through a hole formed in a central portion of the steering nut 24.

[0027] The upper part side of the shaft 23 passes upward through the lid 18, and its upper end enters a turning angle sensor 25 fixed on the lid 18. The turning angle sensor 25 is a well known sensor using an electric re-

sistor or the like. The sensor detects a turning angle of relative rotation of the shaft 23 to the main body 17 of the steering damper 10, thereby detects a turning angle of the steering shaft 14 which integrally rotates with the shaft 23, and outputs a detection signal to a control device to be described later.

[0028] The steering damper 10 in Fig. 3 shows the structure on the main body 17 side except the lid 18. Numeral 26 denotes an approximately sector-shaped hydraulic chamber formed by a concave member provided in the main body 17; 27, a right hydraulic chamber; 28, a left hydraulic chamber; 30, a wing-shaped partition wall separating these left and right hydraulic chambers with one end integrated with the shaft 23 to rotate integrally with the shaft 23; 31, a control valve; and 32, the above-described control device.

[0029] Note that the main switch 15, the steering shaft 14 and the shaft 23 are positioned on approximately the same straight line to a vehicle body center line C, and a key hole 15a is positioned on or around the vehicle body center line C. Further, the main switch 15, the control valve 31 and the control device 32 are positioned on opposite sides in frontward and rearward directions with the steering shaft 14 therebetween. The control valve 31 and the control device 32 are provided in left and right positions with the vehicle body center line C therebetween, and the control valve 31 and the control device 32 are attached to a rear part of the main body 17.

[0030] Fig. 4 schematically shows the structure of the steering damper 10. In the steering damper 10, the sector-shaped hydraulic chamber 26 expanding rearward is provided, the shaft 23 is positioned in the pivotal point of the sector, and the inside of the hydraulic chamber 26 is separated into two parts, the right hydraulic chamber 27 and the left hydraulic chamber 28 by the partition wall 30 extended rearward integrally with the shaft 23. The partition wall 30 interlocked with the rotation of the shaft 23 is rotatable in the hydraulic chamber 26 about the shaft 23.

[0031] A rotation radial direction inner end 30a of the partition wall 30 is integral with the shaft 23, and a rotation radial direction outer end 30b of the partition wall 30 as the other end side is in slide contact with an inner surface of an arc wall 29 of the hydraulic chamber 26 and rotates along the inner surface. The right hydraulic chamber 27 and the left hydraulic chamber 28 are filled with non-compressive type liquid such as oil, and communicated with each other via a liquid passage 33. Accordingly, when the front wheel performs oscillation leftward and rightward, the working liquid moves from one hydraulic chamber, where the capacity is reduced by rotation of the partition wall 30 interlocked with the front wheel via the steering shaft 14 and the shaft 23 (phantom line in Fig. 3), through the liquid passage 33, to the opposite expanded hydraulic chamber in correspondence with the change in capacity of hydraulic chamber.

[0032] A control valve 31 is provided in a middle part of the liquid passage 33. The control valve 31 has a lock 34 to stop liquid movement in the liquid passage 33 and a throttle 35 to cause a damping force by limiting the liquid movement in the liquid passage 33.

[0033] The lock 34 and the throttle 35 are selected in correspondence with the main switch 15. When the main switch 15 is turned OFF, the control valve 31 moves downward in the figure, i.e., in a direction crossing the liquid passage 33, against a return spring 36. The lock 34 is connected to the liquid passage 33 to block the connection between the left and right hydraulic chambers 27 and 28, thereby sets the passage to a working liquid locked status (illustrated status) where the liquid movement is stopped. In the working liquid locked status, as the partition wall 30 becomes unrotatable, the steering shaft 14 also becomes unrotatable via the shaft 23. The handle 4 is unrotatably fixed to a handle locked status.

[0034] On the other hand, when the main switch 15 is turned ON, the control valve 31 moves upward in the figure by the return spring 36, and the throttle 35 is connected to the liquid passage 33 such that the left and right hydraulic chambers 27 and 28 are communicated with each other, thereby liquid movement between the hydraulic chambers becomes possible. Further, the throttle 35 reduces a cross-sectional area of the liquid passage 33 to limit the liquid movement of the working liquid in accordance with change in capacity between the left and right hydraulic chambers 27 and 28 to cause a damping force.

[0035] Further, as the throttle 35 is a variable throttle passage, the above-described damping force can be variable by changing the cross-sectional area of the passage. Thus a damping force corresponding to the turning angle of the steering shaft 14 is generated. The amount of limitation in the variable throttle passage is controlled by the control valve 31, and the throttle operation by the control valve 31 and the above-described switching between the lock 34 and the throttle 35 are controlled by an operation control device 32. The control valve 31 of the present working example comprises a linear solenoid which linearly moves its driving member.

[0036] The control device 32, comprising an ECU or the like, controls the control valve 31 based on an ON/OFF signal from the main switch and the detection signal from the turning angle sensor 25. First, the switching between the lock 34 and the throttle 35 is made as follows. When the main switch 15 is turned OFF, the control device 32 which detects the turning off of the switch moves the control valve 31 to connect the lock 34 to the liquid passage 33, so as to set the handle locked status. On the other hand, when the main switch 15 is turned ON, the control device 32 which detects the turning on of the switch moves the control valve 36 upward in the figure to connect the throttle 35 to the liquid passage 33, so as to set a damping force generation status.

[0037] In the throttle control, in a status where the throttle 35 is connected to the liquid passage 33, the control device 32 calculates a turning angle speed by

differentiating the turning angle detected by the turning angle sensor 25 by time, and adjusts a damping force to an appropriate value by changing the throttle of the control valve 31 in correspondence with the turning angle speed.

[0038] Next, operations of the present working example will be described. Upon travel in a straight line, a rider holds the handle in a neutral position, however, when the front wheel 1 performs oscillation due to road surface condition, the control device 32 controls the control valve 31 in correspondence with the turning angle speed of the oscillating to generate an appropriate damping force. Accordingly, when the turning angle speed of the steering shaft 14 is small, a small damping force is generated to attain agile handle operation. As the turning angle speed of the steering shaft 14 increases, a greater damping force is generated to appropriately regulate the rotation of the partition wall 30, further appropriately regulate the rotation of the steering shaft 14 via the shaft 23, thereby effectively prevent kick back.

[0039] Further, a working liquid lock mechanism is formed by providing the control valve 31 with the lock 34, the mechanism can be used as a theft prevention handle lock mechanism which can be used as a low-price and light-weight handle lock in place of the conventional handle lock. Further, if this handle lock is used with the conventional handle lock, higher-level theft prevention mechanism can be realized.

[0040] Further, among the parts constructing the steering damper 10, as the comparatively light-weight partition wall 30 as the steering side is coupled to the top bridge 11 and the most part including the heavier main body 17 is fixed to the head 3a on the vehicle body side, the increase in steering inertia can be suppressed. Further, the space-saving shaft 23 side is provided on the comparatively space-lacking steering shaft 14 and the greater main body 17 side is provided on the comparatively spacious vehicle body, the steering damper 10 can be easily provided.

[0041] In addition, as the hydraulic chamber 26 can be provided in the main body 17 in the rear of the steering shaft 14 and on the head 3a, the hydraulic chamber 26, having the approximately sector shape where its rear side expands for accommodation of the partition wall 30 which rotates in approximate sector shape about the shaft 23 coaxial with the steering shaft 14, can be provided without difficulty. Further, the capacity of the hydraulic chamber 26 can be increased and the damper effect can be further improved.

[0042] Further, as the major portion of the steering damper 10 and the main switch 15 are positioned on opposite sides with the steering shaft 14 therebetween, the steering damper 10 can be provided sufficiently away from the main switch 15 so as not to disturb key operation at the main switch 15, thereby excellent operability of the key 16 to the main switch 10 can be maintained.

[0043] Further, as the shaft 23 as the rotation shaft of the turning angle sensor 25 is coupled to the steering shaft 14 by engagement, the shaft 23 and the steering shaft 14 can be easily coupled, and by directly connecting the both shafts, the turning angle of the steering shaft 14 can be precisely measured.

[0044] Note that Fig. 4 is a schematic diagram showing the structure of the steering damper 10 as a principle, and is different from the actual structure shown in Fig. 3 in the arrangement of the liquid passage 33, the control valve 31 and the control device 32. However, the arrangement as shown in Fig. 4 can be employed. In this case, as the variable throttle of the liquid passage 33 and the control valve 31 and the control device 32 as control members for the variable throttle are provided on the vehicle body front side as an opposite side to the rotation radial direction outer end 30b of the partition wall 30 with the steering shaft 14 therebetween, the liquid passage 33 can be comparatively short and can be provided around the steering shaft 14. Further, the variable throttle of the liquid passage 33 and the control valve 31 and the control device 32 as control members for the variable throttle can be provided, with spatial allowance, in a position away from the rotation radial direction outer end 30b of the partition wall 30 where the width of the hydraulic chamber 26 most expands.

[0045] Fig. 5 shows the steering damper in another working example regarding the arrangement of the turning angle speed sensor, which is an expanded view of the corresponding part in Fig. 2. In the following description, corresponding elements have the same reference numerals. In this figure, the turning angle speed sensor 25 is provided in a position in the rear of the steering shaft 14 and below a bottom of the main body 17, and a coaxial gear 40 is engaged with a gear 41 coaxial with the steering shaft 14. Note that a rotation shaft 42 of the turning angle speed sensor 25 is not coaxial with the shaft 23 and the steering shaft 14. The shaft 23 is engaged with the steering shaft 14 as in the case of the previous working example.

[0046] In this arrangement, the turning angle speed sensor 25 is provided between the top bridge 11 and the main body 17 of the steering damper 10, and the rotation shaft 42 of the turning angle speed sensor 25 and the steering shaft 14 are separately provided as a two axial structure. As the both shafts are coupled by gears 40 and 41, the turning angle speed sensor 25 can measure an arbitrarily amplified turning angle by setup of gear ratio. Further, as an engagement portion between the gears 40 and 41 and the like are covered by the main body 17, there is no fear of entrance of foreign material in such portion, and the outer appearance is improved. Note that the steering shaft 14 and the shaft 23 may be interlocked with each other by other members than the gears, e.g. a link mechanism.

[0047] Note that the present invention is not limited to the above-described working examples but various modifications and applications can be made within the same principle of the invention. For example, the cou-

pling between the shaft 23 and the steering shaft 14 may be made by other proper methods such as bolt fixing than engagement. Further, the shaft 23 is not necessarily provided coaxially with the steering shaft 14.

[0048] In summary, if a steering damper is fixed to a top bridge, as the steering damper is comparatively heavy and the top bridge is on the steering side, steering inertia increases. Accordingly, arrangement structure of the steering damper which does not greatly influence the steering inertia is realized.

[0049] A rotatable partition wall 30 is provided in a hydraulic chamber 26 of a steering damper 10 to partition the inside into right hydraulic chamber 27 and left hydraulic chamber 28. A shaft 23 provided at one end of the partition wall 30 is integrally and rotatably coupled to a coaxial steering shaft 14. The both hydraulic chambers 27 and 28 are communicated with each other by a liquid passage 33, and a control valve 31 provided in an intermediate part of the passage is switched to a lock 34 or a throttle 35 thereby a damping force zero status or a damping force generation status is set. The switching is controlled by a control device 32 in correspondence with ON/OFF of a main switch 15. Further, the throttle 35 makes a cross-sectional area of the passage variable, and this control is also made by the control device 32 based on a turning angle speed of the steering shaft 14. A comparatively heavy part such as a main body 17 forming a casing of the steering damper 10 is fixed to a vehicle body front part supporting the steering shaft 14, and the comparatively light-weight partition wall 30, on the steering side.

Claims

1. A saddle-ride type vehicle steering damper apparatus in a saddle-ride type vehicle having a steering damper (10) in which a hydraulic chamber (26) filled with working liquid is formed, in a casing (17), the inside of said hydraulic chamber (26) is partitioned into two small hydraulic chambers (27, 28) by a rotatable partition wall (30) provided in the hydraulic chamber, these small hydraulic chambers (27, 28) are communicated with each other via a liquid passage with a throttle (35), and a damping force is caused by relative rotation between said partition wall (30) and said hydraulic chamber (26),
wherein a rotation shaft (23) of said partition wall (30) is coupled to a steering shaft (14) supported rotatably to a vehicle body front part (3a),
and wherein said casing (17) is fixed to said vehicle body front part (3a).

2. The saddle-ride type vehicle steering damper apparatus according to claim 1, wherein said partition wall (30) has said rotation shaft (23) at its rotation radial direction inner end (30a), and wherein a rotation radial direction outer end (30b) as the other end rotates along an inner wall (29) of said hydraulic chamber (26).

3. The saddle-ride type vehicle steering damper apparatus according to claim 2, wherein a main switch (15) is provided in a top bridge (11) supported rotatably to said vehicle body front part (3a) via said steering shaft (14), and wherein the main switch (15) and the rotation radial direction outer end of said partition wall (30) are provided to be opposite to each other with said steering shaft (14) therebetween.

4. The saddle-ride type vehicle steering damper apparatus according to claim 2, wherein the throttle (35) of said liquid passage and the rotation radial direction outer end (30b) of said partition wall (30) are provided to be opposite to each other with said steering shaft (14) therebetween.

5. The saddle-ride type vehicle steering damper apparatus according to claim 2, wherein said throttle (35) has a variable throttle mechanism (31), and wherein a control member (32) of the variable throttle mechanism (31) and said partition wall (30) are provided to be opposite to each other with said steering shaft (14) therebetween.

6. The saddle-ride type vehicle steering damper apparatus according to claim 1, wherein said casing (17) is provided above said steering shaft (14) and a turning angle sensor (25) is provided above said casing (17), and wherein a rotation shaft (42) of the turning angle sensor (25) is coupled to the rotation shaft (23) of said partition wall (30).

FIG. 1

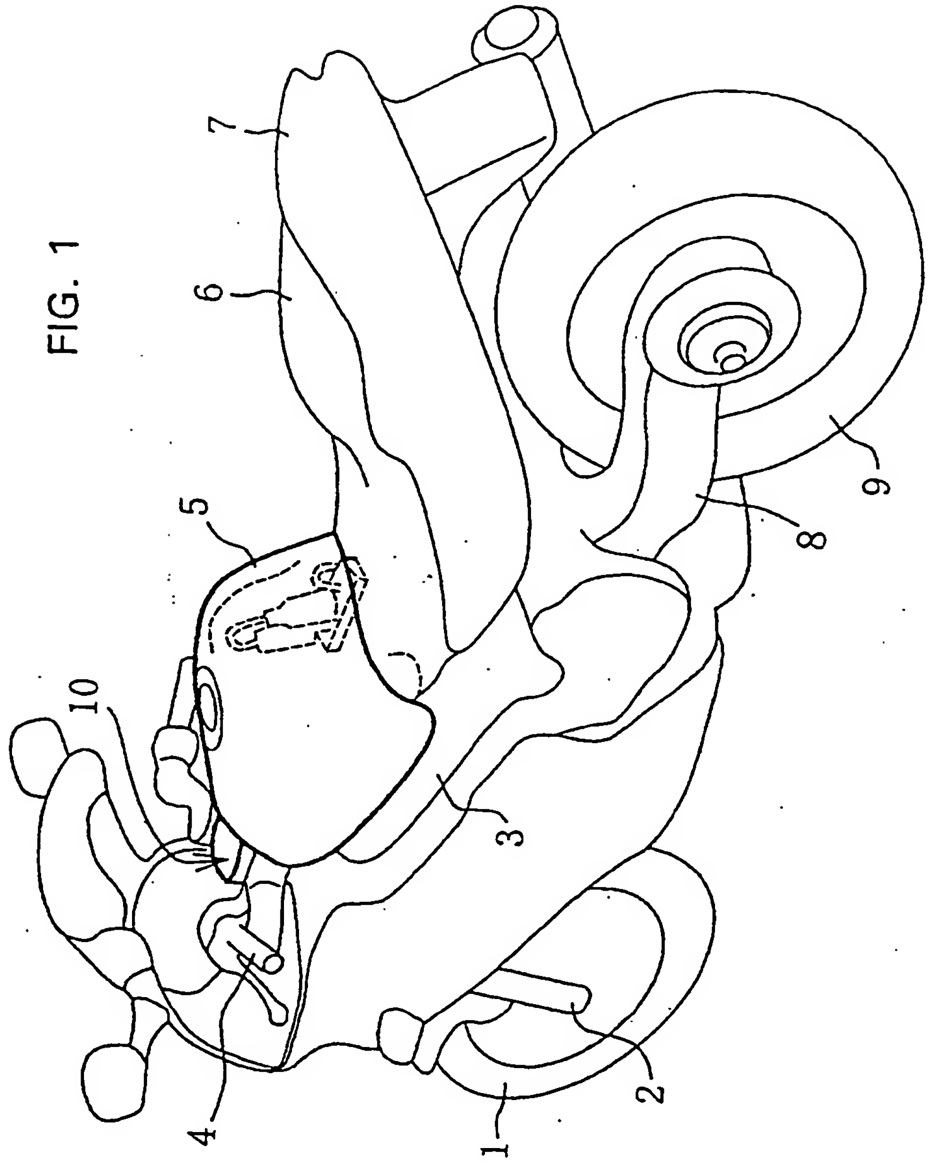

FIG. 2

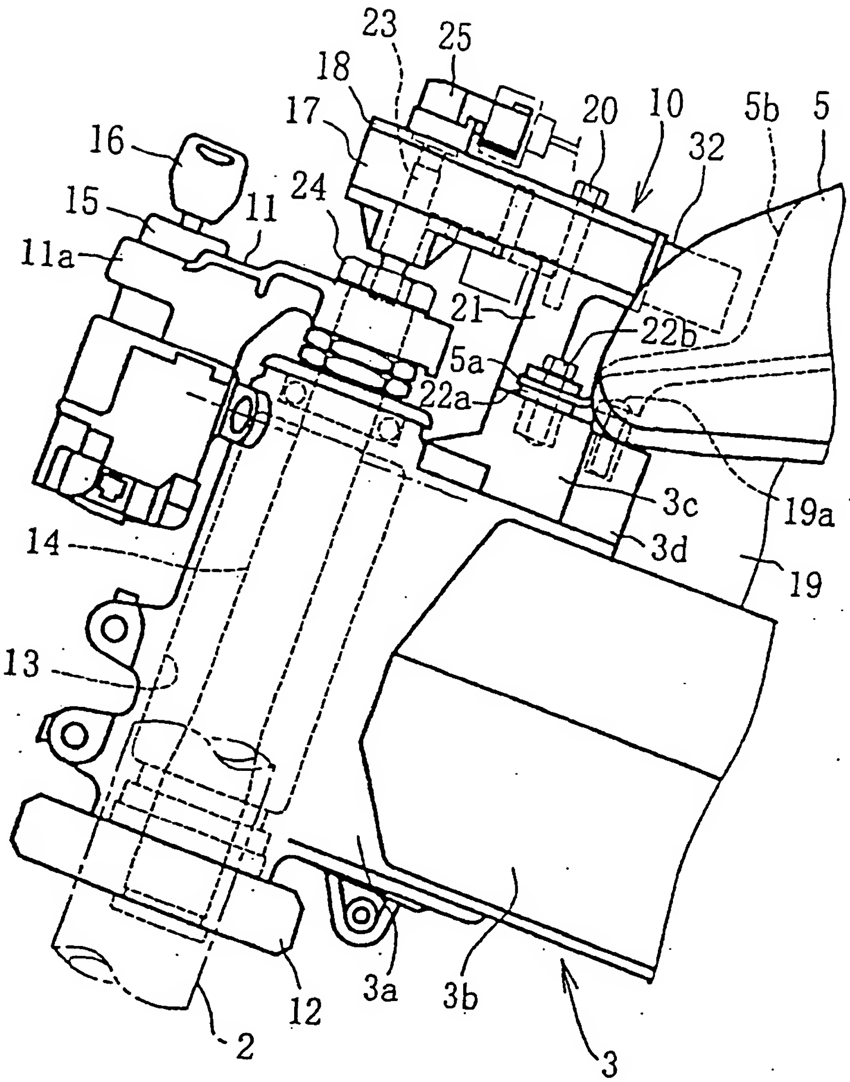
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FIG. 3

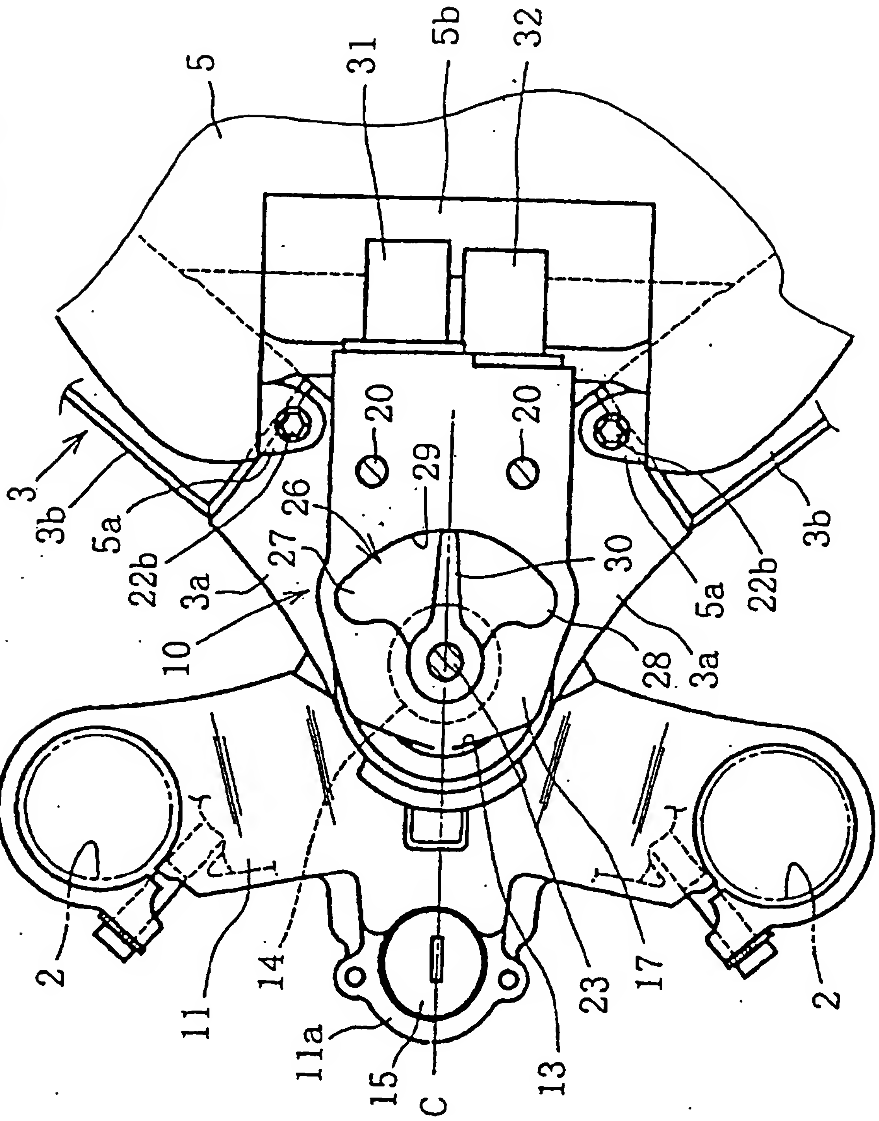
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FIG. 4

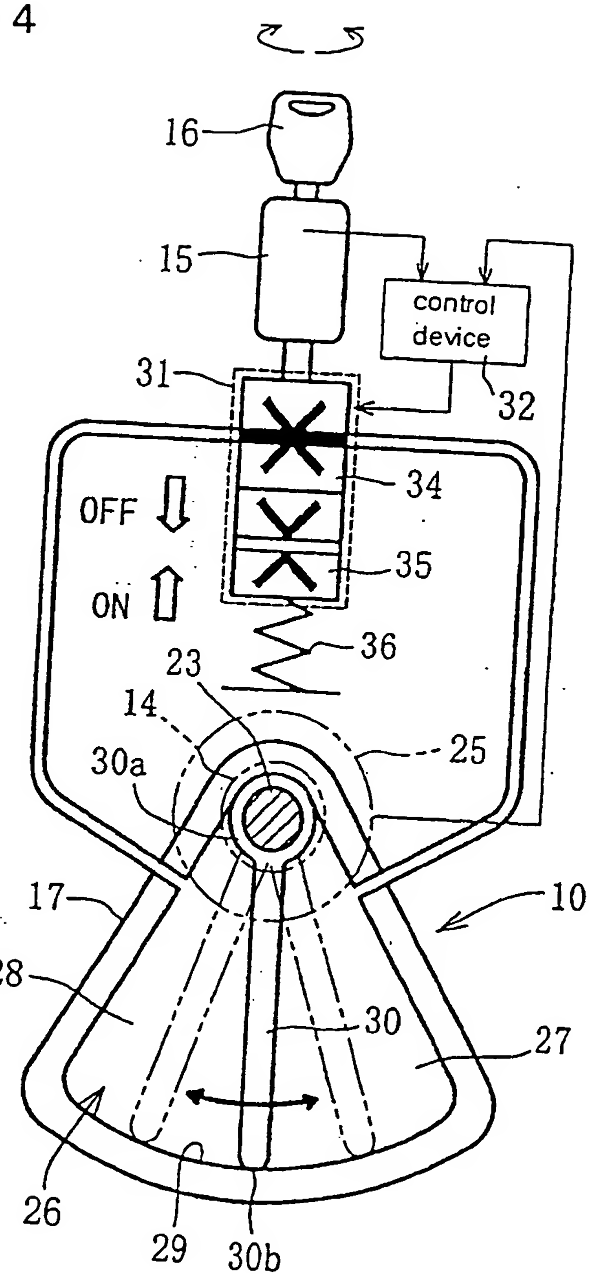
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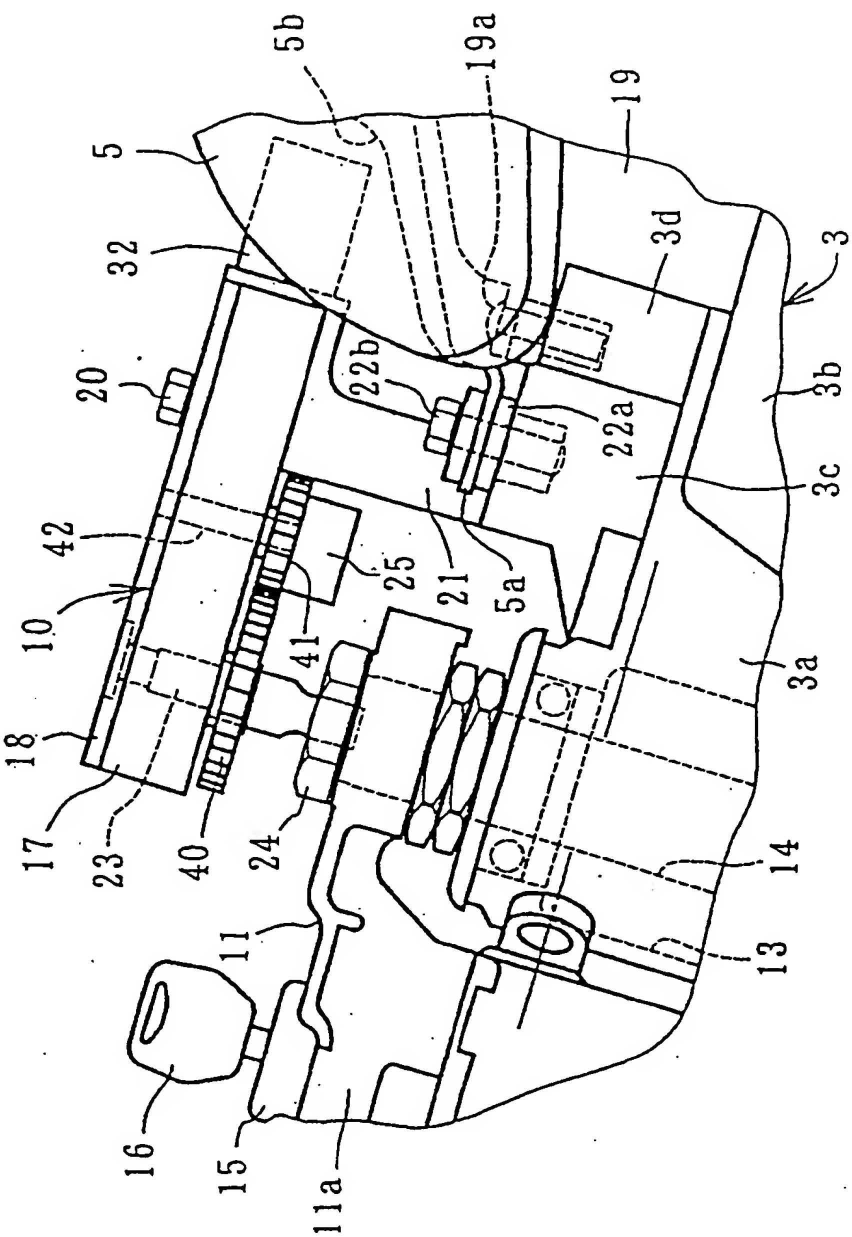
FIG. 5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ABSTRACT / ZUSAMMENFASSUNG / ABREGE

04006414.9

A steering damper (51) in a motorcycle includes a vane partitioning a chamber in a damper housing (52) into two oil chambers, wherein hydraulic fluid flows between the two chambers to generate attenuating force. The steering damper (51) also includes a damper shaft (53) connected to the vane and supporting the vane for rocking motion with respect to the housing (52), and a hydraulic pressure control valve. The housing is attached to a head pipe (3), and the damper shaft (53) is attached to a steering system. When the head pipe (3) is to be attached to the housing (52), the housing (52) is extended rearwardly behind a top bridge (49), and a linear solenoid (69) for driving and controlling the hydraulic pressure control valve is attached to the housing (52) and disposed below the extension thereof.

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